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EOSDIS Core System Project

Release 6B NameServer Database Design and Schema Specifications for the ECS Project

September 2002

Raytheon Company
Upper Marlboro, Maryland

Release 6B
NameServer Database Design and Schema Specifications for the ECS Project

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Preface

This document describes the data design and database specification for the Subscription Server subsystem. It is one of eleven documents comprising the detailed database design specifications for each of the ECS subsystems.

The subsystem database design specifications for the as delivered system include:

311-CD-620-001	Release 6B Data Management (DM) Subsystem Database Design and Database Schema Specifications for the ECS Project
311-CD-621-001	Release 6B Ingest Subsystem Database Design and Database Schema Specifications for the ECS Project
311-CD-622-001	Release 6B Interoperability Subsystem (IOS) Database Design and Database Schema Specifications for the ECS Project
311-CD-623-001	Release 6B Planning and Data Processing Subsystem (PDPS) Database Design and Database Schema Specifications for the ECS Project
311-CD-624-001	Release 6B Science Data Server (SDSRV) Subsystem Database Design and Database Schema Specifications for the ECS Project
311-CD-625-001	Release 6B Storage Management (STMGMT) Subsystem Database Design and Database Schema Specifications for the ECS Project
311-CD-626-001	Release 6B Subscription Server (SUBSRV) Subsystem Database Design and Database Schema Specifications for the ECS Project
311-CD-627-001	Release 6B Management Support Subsystem (MSS) Database Design and Database Schema Specifications for the ECS Project
311-CD-628-001	Release 6B Configuration Registry Subsystem (CONFIG) Database Design and Database Schema Specifications for the ECS Project
311-CD-630-001	Release 6B PDS Subsystem Database Design and Database Schema Specification
311-CD-631-001	Release 6B Name Server Subsystem Database Design and Database Schema Specification

This document is a contract deliverable with an approval code 2. As such, it does not require formal Government acceptance. Contractor approved changes to this document are handled in accordance with change control requirements described in the EOS Configuration Management Plan. Changes to this document will be made by document change notice (DCN) or by complete revision.

Entity Relationship Diagrams (ERDs) presented in this document have been exported directly from tools and some cases contain too much detail to be easily readable within hard copy page constraints. The reader is encouraged to view these drawings on-line using the Portable Document Format (PDF) electronic copy available via the ECS Data Handling System (ECS) on the world wide web at http://edhs1.gsfc.nasa.gov.

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Abstract

This document outlines Release 6B “as-built” database design and database schema of the NameServer database including the physical layout of the database and initial installation parameters.

Keywords: data, database, design, configuration, database installation, scripts, security, data model, data dictionary, replication, performance tuning, SQL server, database security, replication, database scripts

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Change Information Page

List of Effective Pages	
Page Number	**Issue**
Title	Submitted as Final
iii through xii	Submitted as Final
1-1 and 1-2	Submitted as Final
2-1 and 2-2	Submitted as Final
3-1 through 3-6	Submitted as Final
4-1 and 4-2	Submitted as Final
5-1 through 5-4	Submitted as Final
6-1 and 6-2	Submitted as Final
A-1 and A-2	Submitted as Final
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Contents

4. Performance and Tuning Factors

5. Database Security

6. Scripts

List of Figures

List of Tables

Appendix A. NameServer Subsystem Entity Relationship Diagrams

Abbreviations and Acronyms

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1. Introduction

1.1 Identification

This NameServer (NM) Database Design and Database Schema Specification document, Contract Data Requirement List (CDRL) Item Number 050, whose requirements are specified in Data Item Description DID 311/DV2, is a required deliverable under the Earth Observing System (EOS) Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000.

1.2 Scope

The NM Database Design and Database Schema Specification document describes the data design and database specifications to support the data requirements of Release 6B NM software.

1.3 Purpose

The purpose of the NM Database Design and Database Schema Specification document is to support the maintenance of NM data and databases throughout the life cycle of ECS. This document communicates the database implementation in sufficient detail to support ongoing configuration management.

1.4 Audience

This document is intended to be used by ECS maintenance and operations staff. The document is organized as follows:

Section 1 provides information regarding the identification, purpose, scope and audience of this document.

Section 2 provides a listing of the related documents, which were used as a source of information for this document.

Section 3 contains the NM physical data model which is the database table.

Section 4 provides a description of database performance and tuning features such as indexes, caches, and data segments.

Section 5 provides a description of the security infrastructure used and a list of the users, groups, and permissions available upon initial installation.

Section 6 provides a description of database and database related scripts.

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2. Related Documents

2.1 Applicable Documents

The following documents, including Internet links, are referenced in this document, or are directly applicable, or contain policies or other directive matters that are binding upon the content of this volume.

305-CD-610	Release 6B Segment Design Specification for the ECS Project
920-TDG-009	DAAC Hardware Database Mapping/GSFC
920-TDN-009	DAAC Hardware Database Mapping/NSIDC
920-TDE-009	DAAC Hardware Database Mapping/EDC
920-TDL-009	DAAC Hardware Database Mapping/LARC
920-TDS-009	DAAC Hardware Database Mapping/SMC
920-TDG-010	DAAC Database Configuration/GSFC
920-TDN-010	DAAC Database Configuration/NSIDC
920-TDE-010	DAAC Database Configuration/EDC
920-TDL-010	DAAC Database Configuration/LARC
920-TDS-010	DAAC Database Configuration/SMC
920-TDG-011	DAAC Sybase Log Mapping/GSFC
920-TDN-011	DAAC Sybase Log Mapping/NSIDC
920-TDE-011	DAAC Sybase Log Mapping/EDC
920-TDL-011	DAAC Sybase Log Mapping/LARC
920-TDS-011	DAAC Sybase Log Mapping/SMC
922-TDG-013	Disk Partitions/GSFC
922-TDN-013	Disk Partitions/NSIDC
922-TDE-013	Disk Partitions/EDC
922-TDL-013	Disk Partitions/LARC
922-TDS-013	Disk Partitions/SMC

These documents are maintained as part of the ECS baseline and available on the world wide web at the URL: http://cmdm.east.hitc.com/baseline. Please note that this is a partial mirror site in that some items are not available (they are identified) since this is OPEN to all. This site may also be reached through the EDHS homepage. Scroll page to the connections line and click on the ECS Baseline Information System link.

2.2 Information Documents

The following documents, although not directly applicable, amplify or clarify the information presented in this document. These documents are not binding on this document.

313-CD-610	Release 6B CSMS/SDPS Internal ICD for the ECS Project
609-CD-610	Release 6B Operations Tools Manual for the ECS Project
611-CD-610	Release 6B Mission Operation Procedures for the ECS Project

3. Data Design

3.1 Database Overview

The NM database implements the large majority of the persistent data requirements for the NM subsystem. The database is designed in such a manner as to satisfy business policy while maintaining data integrity and consistency. Database tables are implemented using the Sybase Relational Database Management system (RDBMS). All components of the NM database are described in the sections, which follow.

3.1.1 Physical Data Model Entity Relationship Diagram

The Entity Relationship Diagram (ERD) presents a schematic depiction of the NM physical data model. The ERDs presented here for the NM database were produced using the Power Designor Data Architect Computer Aided Software Engineering (CASE) tool. ERDs represent the relationship between entities or database tables. The key for the symbols used in the ERDs are as follows in Figure 3-1.

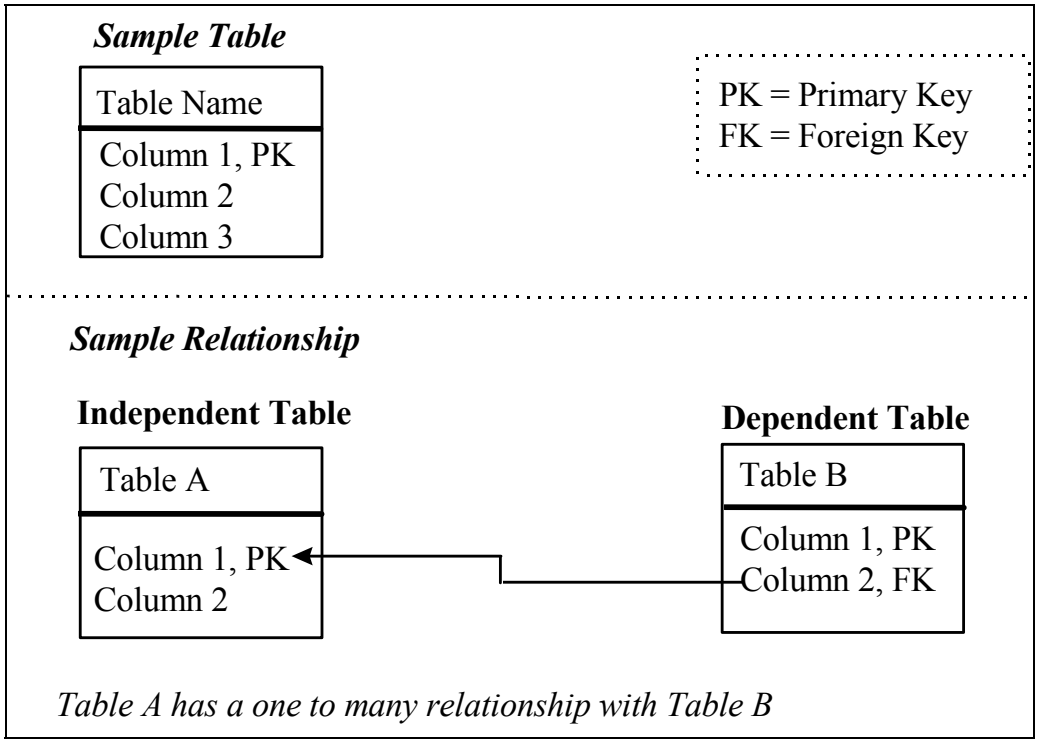

Figure 3-1. ERD Key

The ERDs for the NM database are shown in Appendix A.

3.1.2 Tables

A listing of each of the tables in the NM database is given in table 3-1. A brief definition of each of these tables follows.

Table 3-1. NM Database Tables Listing

Table Name	Logical Grouping
CsNameServerMet	To store the service of all applications for NameServer/DCE replacement
EcDbDatabaseVersions	Database Versioning

Table 3-2 contains the set of user and groups access criteria applicable to a specific configuration node.

Table 3-2. CsNameServerMet (1 of 2)

Name	Type	PK	Mandatory
EntryId	varchar(32)	Yes	Yes
HostName	varchar(32)	Yes	Yes
BindInfoType	int	No	No
BindInfoSfld1	varchar(32)	No	No
BindInfoSfld2	varchar(32)	No	No
BindInfoSfld3	varchar(32)	No	No
BindInfoSfld4	varchar(32)	No	No
BindINfoSfld5	varchar(32)	No	No
BindInfoIfld1	integer	No	No
BindInfoIfld2	integer	No	No
BindInfoIfld3	integer	No	No
BindInfoIfld4	integer	No	No
BindInfoIfld5	integer	No	No
ProcId	integer	No	No
ProcName	varchar(32)	No	No
ProcType	varchar(32)	No	No
ProcMode	varchar(10)	No	No
StringId	varchar(32)	No	No
SubsysId	varchar(32)	No	No
Service	varchar(32)	No	No
ServInst	varchar(32)	No	No
Spacecraft	varchar(32)	No	No
IpcType	varchar(32)	No	No

Table 3-2. CsNameServerMet (2 of 2)

Name	Type	PK	Mandatory
SMode	varchar(10)	No	No
UserGroup	varchar(12)	No	No
UserName	varchar(20)	No	No
UserRole	varchar(20)	No	No
PoxyId	integer	No	No

Table 3-3. EcDbDatabaseVersions

Name	Type	PK	Mandatory
EcDbSchemaVersionID	Smallint	Yes	Yes
EcDbDropVersion	Char(64)	No	Yes
EcDbDropDescription	Varchar(255)	No	Yes
EcDbCurrentVersionFlag	Char(1)	No	Yes
EcDbDatabaseName	Varchar(255)	No	No
EcDbDropInstallDate	Datetime	No	No
EcDbSybaseVersion	Varchar(255)	No	No
EcDbSybaseServer	Varchar(255)	No	No
EcDbComments	Varchar(255)	No	No
EcDbUpdateProcess	Varchar(255)	No	No

3.1.3 Columns

A listing of each of the columns in the NM database is given in table 3-4. A brief definition of each of the columns follows.

Table 3-4. Column Definitions (1 of 3)

Column Code	Table	Definition
EntryId	CsNameServerMet	HostName:Port_Number:ProcId
HostName	CsNameServerMet	Machine name on which the server is running. Such as f2spg01, f2mss01.
BindInfoType	CsNameServerMet	A RogueWave Class Id which is a pointer to the EndPoint Object. This objects contains the Bind information for the machine address.
BindInfoSfld1	CsNameServerMet	Bind information field in the EndPoint Object that contains the Port Number.
BindInfoSfld2	CsNameServerMet	Not Used

Table 3-4. Column Definitions (2 of 3)

Column Code	Table	Definition
BindInfoSfld3	CsNameServerMet	Not Used
BindInfoSfld4	CsNameServerMet	Not Used
BindINfoSfld5	CsNameServerMet	Not Used
BindInfoIfld1	CsNameServerMet	Bind information integer field in the EndPoint Object that contains the Port Number.
BindInfoIfld2	CsNameServerMet	Not Used
BindInfoIfld3	CsNameServerMet	Not Used
BindInfoIfld4	CsNameServerMet	Not Used
BindInfoIfld5	CsNameServerMet	Not Used
ProcId	CsNameServerMet	Service Process Id for the Service
ProcName	CsNameServerMet	Not Used
ProcType	CsNameServerMet	Not Used
ProcMode	CsNameServerMet	Not Used
StringId	CsNameServerMet	Mode, such as OPS or TS1
SubsysId	CsNameServerMet	Not Used
Service	CsNameServerMet	Not Used
ServInst	CsNameServerMet	Not Used
Spacecraft	CsNameServerMet	Not Used
IpcType	CsNameServerMet	Not Used
SMode	CsNameServerMet	Not Used
UserGroup	CsNameServerMet	Not Used
UserName	CsNameServerMet	Not Used
UserRole	CsNameServerMet	Not Used
PoxyId	CsNameServerMet	Not Used
EcDbComments	EcDbDatabaseVersions	Notes or comments on the database version level.
EcDbCurrentVersionFlag	EcDbDatabaseVersions	Flag indicating if this row represents the current database version entry
EcDbDatabaseName	EcDbDatabaseVersions	The name of the database for which this database versions level is applied.
EcDbDropDescription	EcDbDatabaseVersions	The official name of the ECS software drops for this database version level.
EcDbDropInstallDate	EcDbDatabaseVersions	The date and time that the database versions level was installed.

Table 3-4. Column Definitions (3 of 3)

Column Code	Table	Definition
EcDbDropVersion	EcDbDatabaseVersions	The official description of the ECS software drops for this database version level.
EcDbSchemaVersionId	EcDbDatabaseVersions	The subsystem-specific identifier for this database schema version
EcDbSybaseServer	EcDbDatabaseVersions	The name of the baseline Sybase SQL server controlling this database.
EcDbSybaseVersion	EcDbDatabaseVersions	The software release version of the Sybase SQL server in place when this database version level was initially installed.
EcDbUpdateProcess	EcDbDatabaseVersions	The installation method by which this database version level was installed

3.1.4 Column Domains

Domains specify the ranges of values allowed for a given table column. Sybase supports the definition of specific domains to further limit the format of data for a given column. Sybase domains are, in effect, user-defined data types. There are no domains defined in the NM database.

3.1.5 Rules

Sybase supports the definitions of rules. Rules provide a means for enforcing domain constraints on a given column. There are no rules defined in Sybase for the NM database.

3.1.6 Defaults

Defaults are used to supply a value for a column when one is not defined at insert time. There are no defaults defined in Sybase in the NM database.

3.1.7 Views

Sybase allows the definition of views as a means of limiting an application or users access to data in a table or tables. Views create a logical table from columns found in one or more tables. There are no views defined in the NM database.

3.1.8 Integrity Constraints

Sybase allows the enforcement of referential integrity via the use of declarative integrity constraints. Integrity constraints allow the SQL server to enforce primary and foreign key integrity checks without automatically without requiring programming constraints support "restrict-only" operations. This means that a row cannot be deleted or updated if their are rows in other tables having a foreign key dependency on that row. Cascade delete and update

operations can not be performed if a declarative constraint has been used. There are no declarative integrity constraints defined in the NM database.

3.1.9 Triggers

Sybase supports the enforcement of business policy via the use of triggers. A trigger is best defined as set of activities or checks that should be performed automatically when ever a row is inserted, updated, or deleted from a given table. Sybase allows the definition of insert, update, and delete trigger per table. Currently there are no triggers defined in the NM database.

3.1.10 Stored Procedures

Sybase also includes support for business policy via the use of stored procedures. Stored procedures are typically used to capture a set of activities or checks that will be performed on the database repeatedly to enforce business policy and maintain data integrity. Stored procedures are parsed and compiled SQL code that reside in the database and may be called by name by an application, trigger or another stored procedure.

3.2 File Usage

There are cases when the implementation of a persistent data requirement is better suited to a flat file than to a database table. A common use of files in ECS is as an interface mechanism between ECS and the external world. There are no flat files used in NM.

3.2.1 Files Definitions

Not applicable.

3.2.2 Attributes

Not applicable.

3.2.3 Attribute Domains

Not applicable.

4. Performance and Tuning Factors

4.1 Indexes

An index provides a means of locating a row in a database table based on the value of a specific column(s), without having to scan all data in the table. When properly implemented, indexes can significantly decrease the time it takes to retrieve data, thereby increasing performance. Sybase allows the definition of two types of indexes, clustered and non-clustered.

In a clustered index, the rows in a database table are physically stored in sequence-determined by the index. Clustered indexes are particularly useful, when the data is frequently retrieved in sequential order. Only one clustered index may be defined per table.

Non-clustered indexes differ from their clustered counterpart, in that, data is not physically stored in sorted order—newly added rows are stored at the end of the related database table.

A key of the types of indexes found in NM is provided in Table 4-1 Index Type Key. A description of each of the defined indexes is given in Table 4-2 Index List.

Table 4-1. Index Type Key

Index Type Key	Description
PK	Primary Key

Table 4-2. Index Listing

Table Code	Index Code	Primary Key	Foreign Key	Unique	Clustered
CsNameServerMet	PK_EntryId	Yes	No	Yes	Yes
EcDbDatabaseVersions	PK_MSACVERSIONS	Yes	No	Yes	Yes

4.2 Segments

Sybase supports the declaration of segments. A segment is a named pointer to a storage device(s). Segments are used to physically allocate a database object to a particular storage device. Segments are not defined for the NameServer database.

4.3 Caches

A cache is a block of memory that is used by Sybase to retain and manage pages that are currently being processed. By default, each database contains three caches:

Data cache – retains most recently accessed data and index pages

Procedure cache – retains most recently accessed stored procedure pages

User transaction log cache – transaction log pages that have not yet been written to disk for each user

The size of each of these default caches is a configurable item which must be managed on a per DAAC basis. These caches may be increased or decreased by the DAAC DBA as needed.

The data cache can be further subdivided into named caches. A *named cache* is a block of memory that is named and used by the DBMS to store data pages for select tables and/or indexes. Assigning a database table to named cache causes accessed pages to be loaded into memory and retained. The named cache does not need to be allocated to accommodate the entire database table since the DBMS manages the cache according to use. Named caches greatly increase performance by eliminating the time associated for disk input and output (I/O). There are no named caches that are currently defined for the NM Subsystem database. Named caches may be defined as the memory usage of the NM database becomes better known and the DAACs move into an operational environment. As named caches are defined, this portion of the document will be updated.

There are no named caches for the NM database.

5. Database Security

5.1 Approach

The database security discussed within this section is bounded to security implementation within the Sybase SQL Server DBMS. A Sybase general approach to security is adopted as illustrated in Figure 5-1.

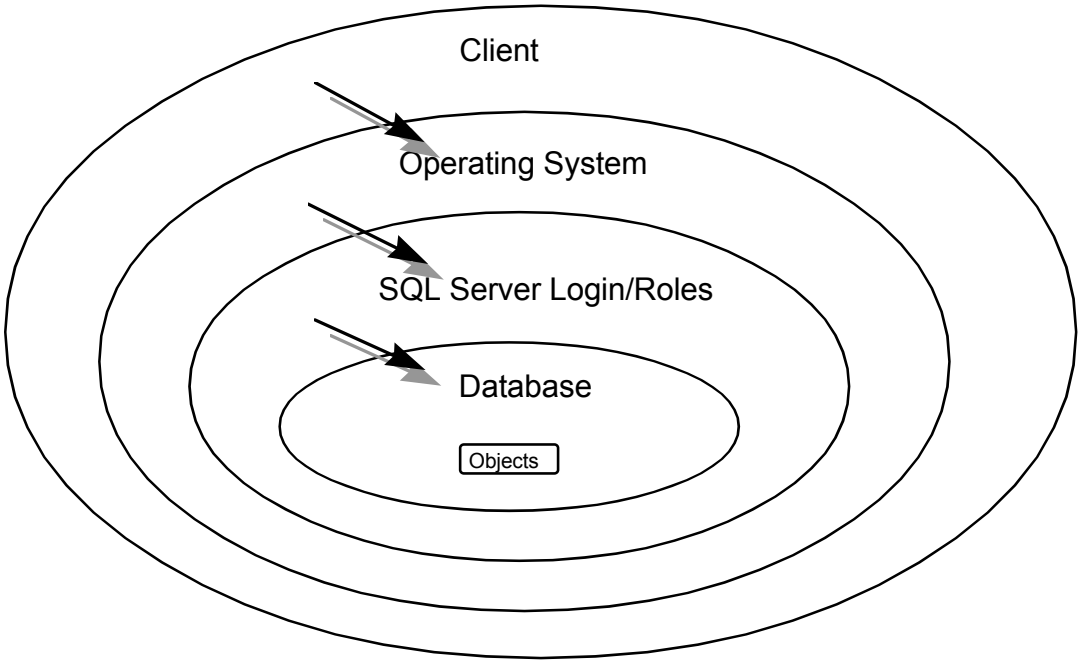

Figure 5-1. Sybase General Approach to SQL Server Security[1]

5.2 Users

The client (user) requires a SQL Server login to access the DBMS. The login is assigned to a user with certain related permissions for gaining access to particular objects (e.g., database tables, views, commands) within the database. The System Administrator may grant or revoke objects permissions for a login individually or based on defined group or roles.

[1] Reference Sybase Student Guide: *Advanced SQL Server A<SUBSYS>inistration*.

5.3 Groups

Groups are a means of logically associating users with similar data access needs. Once a group has been defined, object and command permissions can be granted to that group. A user who is member of a group inherits all of the permissions granted to that group. No groups have been initially defined in the NM Subsystem "default database. The DAACs should define database groups to support the database security requirements of their individual DAACs. Assigning each user to the appropriate group should control security for local DAAC users.

5.4 Roles

Roles were introduced in Sybase to allow a structured means for granting users the permissions needed to perform standard database administration activities and also provide a means for easily identifying such users. There are six pre-defined roles that may be assigned to a user. A definition of each of these roles follows, as well as a description of the types of activities that may be performed by each role.

System Administrator (*sa_role*): This role is used to grant a specific user permissions needed to perform standard system administrator duties including:

0. installing SQL server and specific SQL server modules
1. managing the allocation of physical storage
2. tuning configuration parameters
3. creating databases

Site Security Officer (*sso_role*): This role is used to grant a specific user the permissions needed to maintain SQL server security including:

4. adding server logins
5. administrating passwords
6. managing the audit system
7. granting users all roles except the *sa_role*

Operator (*oper_role*): This role is used to grant a specific user the permissions needed to perform standard functions for the database including:

8. dumping transactions and databases
9. loading transactions and databases

Navigator (*navigator_role*): This role is used to grant a specific user the permissions needed to manage the navigation server.

Replication (*replication_role*): This role is used to grant a specific user the permissions needed to manage the replication server.

Sybase Technical Support (*sybase_ts_role*): This role is used to grant a specific user the permissions needed to execute *database consistency checker (dbcc)*, a Sybase supplied utility supporting commands that are normally outside of the realm of routine system administrator activities.

The DAACs should review these roles and assign them to the appropriate login and/or groups.

5.5 Login/Group Object Permissions

During initial database installation logins used by the ECS custom code were created and permissions assigned for access to the NM Subsystem database. In addition, special database installation login, css_role, was created to support database installation needs. For each login, the level of access is limited to that associated with their login, group or assigned group/role. Object Permissions are set within the installation scripts of the NM Subsystem for each object and group/role.

Permissions are identified in Table 5-1. A specification of the object permissions is contained in Table 5-2.

Table 5-1. Permission Key

Permission	Description
A	All
S	Select
I	Insert
U	Update
D	Delete
E	Execute

Table 5-2. Object Permissions

Group/User	Sybase Login	Object	Select	Insert	Update	Delete	Execute
NmAdminGroup	EcCsNameServer	User Tables	X	X	X	X	

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6. Scripts

6.1 Installation Scripts

Any scripts used to support installation of the NM database are described in Table 6-1.

Table 6-1. Installation Scripts

Script File	Description
EcCsNmDbBuild	Installs/populates NameServer database

6.2 De-Installation Scripts

Any scripts used to support de-installation of the NM database are described in Table 6-2.

Table 6-2. De-Installation Scripts

Script File	Description
EcCsNmDbDrop	Drops database objects

6.3 Backup/Recovery Scripts

Any scripts used to facilitate backup or recovery of the NM database are described in Table 6-3.

Table 6-3. Backup/Recovery Scripts

Script File	Description
EcCsNmDbDump	Creates a backup of the database
EcCsNmDbLoad	Restores the database

6.4 Miscellaneous Scripts

Miscellaneous scripts applicable to the NM database are described in Table 6-4.

Table 6-4. Miscellaneous Scripts

Script File	Description
EcCsNmDbPatch	Install database schema modifications

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Appendix A. NameServer Subsystem Entity Relationship Diagram

CsNameServerMet		
EntryId	VA32	<M>
HostName	VA32	<M>
BindInfoType	I	
BindInfoSfld1	VA32	
BindInfoSfld2	VA32	
BindInfoSfld3	VA32	
BindInfoSfld4	VA32	
BindInfoSfld5	VA32	
BindInfoIfld1	I	
BindInfoIfld2	I	
BindInfoIfld3	I	
BindInfoIfld4	I	
BindInfoIfld5	I	
ProcId	I	
ProcName	VA32	<M>
ProcType	VA32	<M>
ProcMode	VA10	<M>
StringId	VA32	<M>
SubsysId	VA10	<M>
Service	VA10	
ServInst	VA32	
Spacecraft	VA32	<M>
IpcType	VA32	
SMode	VA32	
UserGroup	VA32	<M>
UserName	VA32	<M>
UserRole	VA32	<M>
ProxyId	I	<M>

Figure A-1. NameServer

EcDbVersions			
EcDbSchemaVersionID	<pk>	smallint	not null
EcDbDropVersion		char(64)	not null
EcDbDropDescription		varchar(255)	null
EcDbCurrentVersionFlag		char(10	not null
EcDbDatabaseName		varchar(255)	null
EcDbDropInstallDate		datetime	null
EcDbSybaseVersion		varchar(255)	null
EcDbSybaseServer		varchar(255)	null
EcDbComments		varchar(255)	null
EcDbUpdateProcess		varchar(255)	null

Figure A-2. Database Versions

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Abbreviations and Acronyms

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Exchange
CASE	Computer Aided Software Engineering
CD	contractual delivery 213-001
CDRL	contract data requirements list
CI	configuration item
COTS	commercial off-the-shelf (hardware or software)
CSCI	computer software configuration item
DAAC	Distributed Active Archive Center
DBCC	Database Consistency Checker
DBMS	Database Management System
DCN	Document Change Notice
DID	data item description
DMS	Data Management Subsystem
ECS	EOSDIS Core System
EDC	EROS Data Center
EDHS	ECS Data Handling System
EOSDIS	Earth Observing System Data and Information System
EROS	Earth Resources Observation System
ERD	Entity Relationship Diagram
ESDIS	Earth Science Data and Information System (GSFC)
ESDT	Earth science data types
ESN	EOSDIS Science Network (ECS)
FK	Foreign Key
GSFC	Goddard Space Flight Center
GUI	graphic user interface
HDF	hierarchical data format

HDF-EOS	an EOS proposed standard for a specialized HDF data format
HTML	HyperText Markup Language
HTTP	Hypertext Transport Protocol
I/O	input/output
ICD	interface control document
INGST	Ingest Services CSCI
IOS	Interoperability Subsystem
LaRC	Langley Research Center (DAAC)
MSS	Management Support Subsystem
N/A	not applicable
NAS	National Academy of Science
NASA	National Aeronautics and Space Administration
NSIDC	National Snow and Ice Data Center (DAAC)
ODL	Object Definition Language
PCF	Process Control File
PDF	Portable Document Format
PDPS	Planning and Data Processing Subsystem
PGE	Product Generation Executive
PK	Primary Key
QA	Quality Assurance
SDSRV	Science Data Server CSCI
SQL	Structured Query Language
STMGT	Storage Management Software CSCI
NM	NameServer
WWW	World-Wide Web